

Wetland Management and Lentic Amphibian Communities

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This work is the product of the United States Environmental Protection Agency Office of Research and Development's Regional Applied Research Program

Introduction

In the past two decades, scientists around the world have increasingly noted losses of amphibian populations.¹ Although declines have been noted in wilderness populations, it is particularly chronic in multiple-use landscapes where resource managers face complex conservation problems and must make decisions that affect amphibians.

This study was a joint research effort conducted cooperatively by scientists at the U.S. Environmental Protection Agency, Western Ecology Division and the U.S. Geological Survey, Biological Division/Forest and Rangeland Ecosystem Science Center. The study evaluated the relationships between amphibian communities and hydrology, exotic predators, and landscape context in the Willamette Valley in western Oregon. The purpose of the study was to (1) examine regional patterns in amphibian communities of managed and naturally occurring wetlands and (2) elucidate the influences of site-level and landscape-level wetland characteristics on lentic community composition in the lowlands of western Oregon.

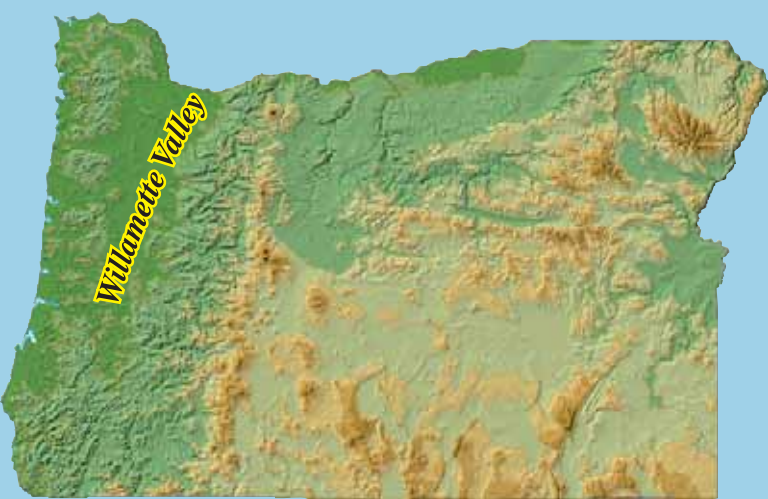


Rough-skinned Newt

Pacific Chorus Frog

Study Area and Native Amphibian Residents

The Willamette Valley lies between the Cascade Range and the Coast Range in western Oregon. It surrounds a 150-km stretch of the north-south trending Willamette River and has an average width of 30 km and an average elevation of about 150 m. Characterized by a sub-maritime climate, the valley is predominantly agricultural, but several rapidly growing urban centers exist. The valley's numerous wetlands were created by river flows or for livestock, recreation, or wetland mitigation. They are a mix of permanent and ephemeral (seasonally inundated) wetlands; the latter tend to fill during fall rains and dry by mid- to late summer.



Five species of native amphibians breed in wetlands of the Willamette Valley (Table 1). Native fish are mostly riverine, but several species arrive with some regularity at wetlands via flooding or connections to riverine habitats, including: the three-spine stickleback (*Gasterosteus aculeatus*), red-side shiner (*Richardsonius balteatus*) and sculpin (*Cottus spp.*).

Amphibian Habitat and Threats

Known threats to amphibians in the Willamette Valley include habitat loss, habitat alteration, and three non-native taxa: fish, bullfrogs and crayfish. Wetland mitigation typically is not designed to replace all ephemeral wetlands that are lost to urban and agricultural development. Emergent wetlands have been reduced by over 50% in the past century, and ephemeral wetlands are often replaced with permanent wetlands.^{2,3} Ephemeral wetlands dry periodically and tend to have large, shallow, emergent areas - a desirable characteristic for some amphibians. Whereas most native amphibians in the Willamette Valley can breed in both ephemeral and permanent wetlands, many are associated with wetlands having large shallow areas less than 0.75 m deep in the spring and emergent vegetation covering at least 50% of the surface area.^{4,5,6}



Largemouth Bass



Bullfrog



Crayfish

Creating a landscape with a disproportionate amount of deeper, more permanent freshwater habitats favors the invasion of non-native animals. A variety of warm-water fish from the sun-fish family (*Centrarchidae*), especially bluegill (*Lepomis macrochirus*), pumpkinseed (*Lepomis gibbosus*) and largemouth bass (*Micropterus salmoides*), have been widely introduced in the Willamette Valley, along with bullfrogs (*Rana catesbeiana*). Bullfrogs usually require at least one year to reach metamorphosis and thus need permanent water.

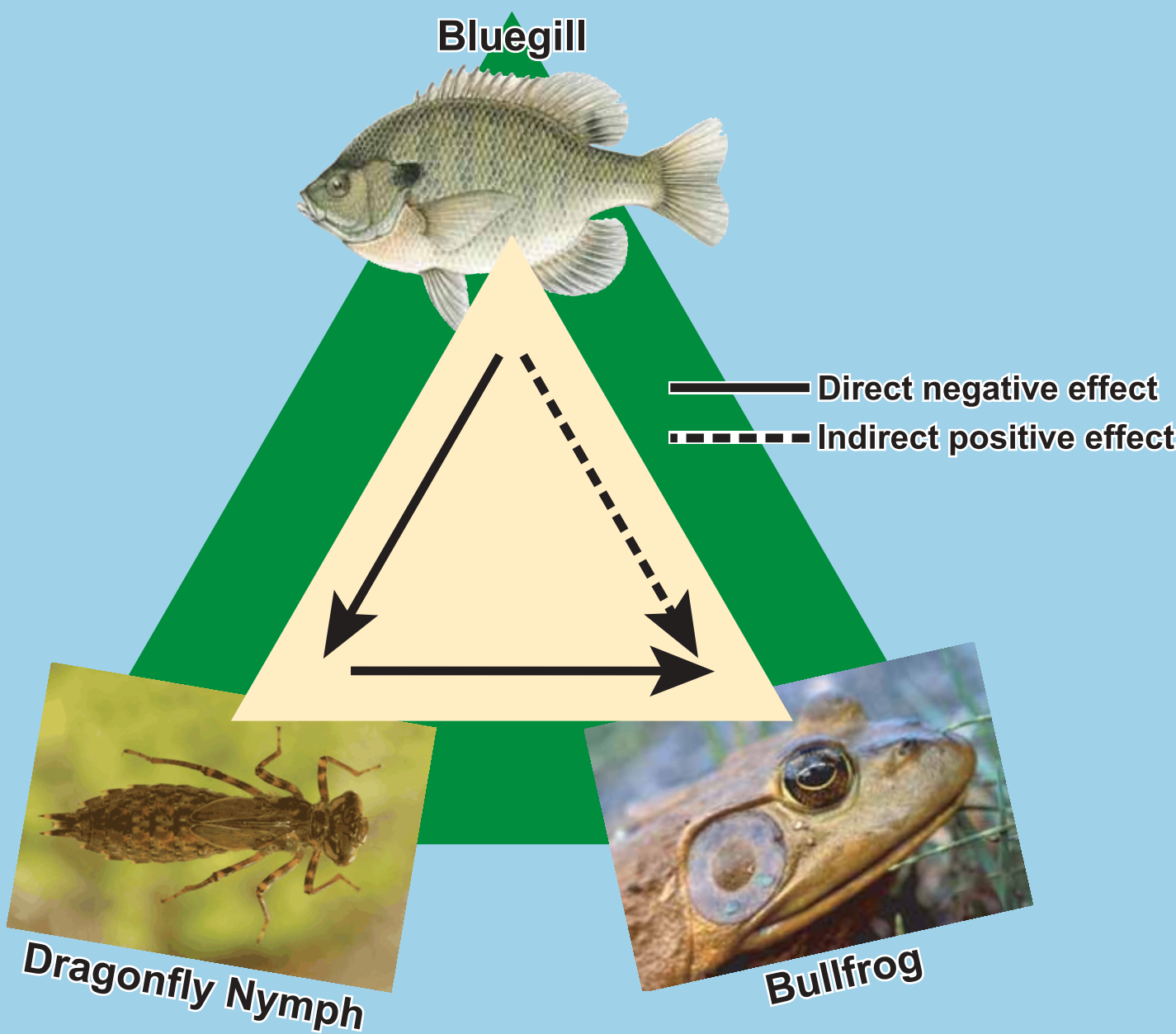
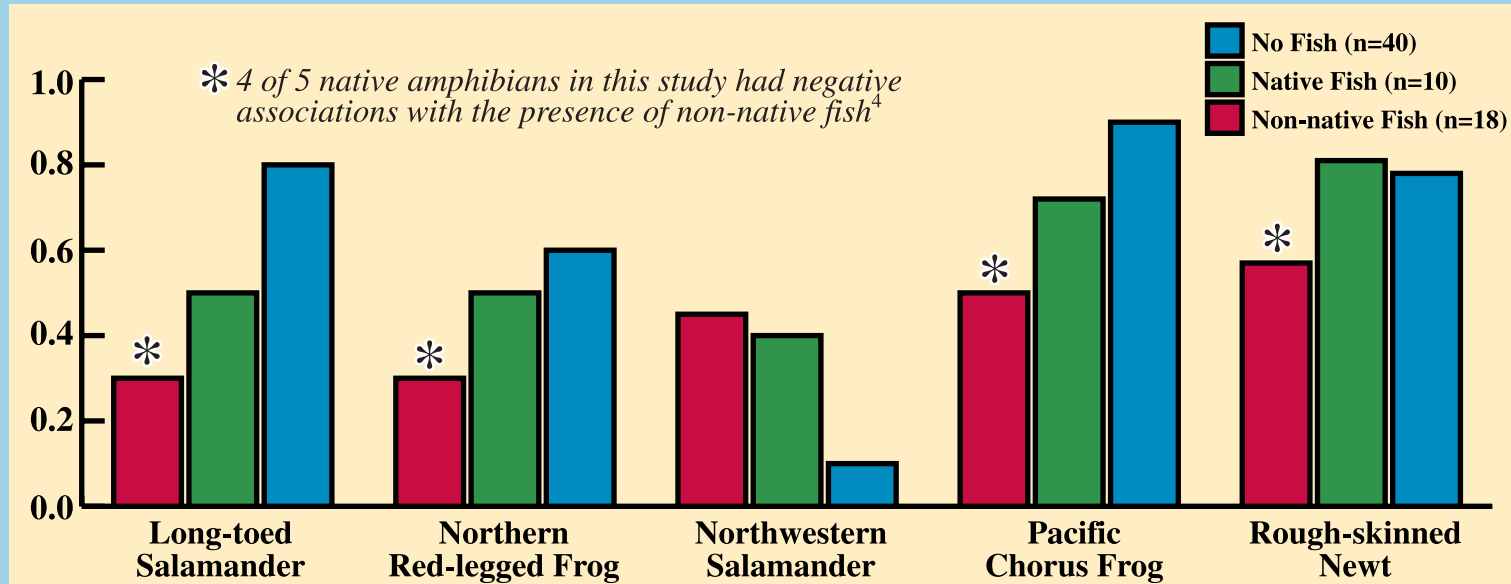
Table 1. Willamette Valley Amphibians

Species Common name	Scientific name	Native	Breeding
Bullfrog	<i>Rana catesbeiana</i>	No	June-August
Long-toed salamander	<i>Ambystoma macrodactylum</i>	Yes	January-February
Northwestern salamander	<i>Ambystoma gracile</i>	Yes	February-April
Pacific chorus frog	<i>Pseudacris regilla</i>	Yes	February-March
Red-legged frog	<i>Rana aurora</i>	Yes	January-March
Rough-skinned newt	<i>Taricha granulose</i>	Yes	February-May

The Problem with Non-Native Fish and Bullfrogs

The potential negative effects of non-native fish and bullfrogs on native amphibians have been recognized for decades. However, a large amount of evidence now suggests that most native amphibians in the Pacific Northwest can coexist with bullfrogs in shallow wetlands that have extensive emergent vegetation and lack non-native fish. Non-native sunfish pose a greater problem, because several of the Willamette Valley native amphibians appear unable to coexist with them in many habitats.^{4,5,6}

Not only do non-native fish appear to be more detrimental to native amphibians than bullfrogs, they also appear to facilitate bullfrog invasion. Wetlands with high densities of dragonfly nymphs (*Aeshnidae*) and perhaps other predaceous macroinvertebrates can offer some resistance to bullfrog invasion. In experimental enclosures, predation by dragonfly nymphs reduced survival of bullfrog tadpoles to zero. But when non-native bluegill sunfish were included, the fish ate the dragonfly nymphs and avoided the bullfrog tadpoles (known to be unpalatable to fish), thereby allowing more bullfrogs to survive. Field studies also found that bullfrogs were strongly associated with relatively deep wetlands hosting non-native fish, suggesting that removing fish from some wetlands would not only have direct benefits for native amphibians but might also help manage the bullfrog problem.



Recommendations for Conserving Wetland Amphibians^{4,5,6,7,8,9}

1. Prevent the introduction and establishment of non-native fish in mitigation wetlands by avoiding sites with connections (seasonal or permanent) to permanent streams.
2. Conserve and create wetlands with at least 50% of their surface area having depths between 0.2 and 0.75 m in the spring.
3. Conserve and create ephemeral and semi-permanent wetlands; they tend to have more emergent vegetation and lack non-native vertebrate species, which benefits native amphibians.



Semi-permanent Wetland



Ephemeral Wetland

Acknowledgement

This poster is based on a fact sheet that resulted from research collaboration between the U.S. EPA and the USGS Forest and Rangeland Ecosystem Science Center, Corvallis, Oregon. That fact sheet, entitled "Wetland Management for Amphibians in the Willamette Valley" (2004), was authored by M. J. Adams, C. A. Pearl, and R. B. Bury.

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